REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended previously considered claim 6 to recite that the second layer "consists of" Co and Cr. In light of this amendment to claim 6, it is respectfully submitted that the objection to claim 6 as set forth in Item 1 on page 2 of the Office Action mailed April 24, 2003, is moot. That is, it is respectfully submitted that claim 6 now further limits the subject matter of claim 1; while claim 1 recites that the second layer "contains" Co and Cr, it is respectfully submitted that claim 6 further limits this claim 1 by reciting that the second layer "consists of" Co and Cr. Applicants have amended claims 2 and 3 to be consistent with claim 1, in reciting the amorphous alloy "layer".

Applicants are adding new claims 9-15 to the application. Claims 9 and 10, each dependent on claim 1, respectively recites that the magnetic layer is the main recording layer of the recording medium; and recites that the magnetic layer is made of a material selected from a specified group of materials. Claims 11 and 12, each also dependent on claim 1, respectively recites that the first layer is a thermal-stabilizing layer of the recording medium, and that the second layer is provided on the surface of the first layer. Claims 13 and 14, dependent respectively on claims 1 and 13, respectively recites further structure of a protective and lubricant layer on the second layer, and recites that the protective and lubricant layer includes carbon, with the second layer suppressing reaction of the carbon; and claim 15, dependent on claim 14, recites materials from which the protective and lubricant layer is made.

In connection with the newly added claims, note, for example, pages 7 and 8 of Applicants' specification.

Applicants respectfully traverse the rejection of their claims on prior art grounds, as set forth in Items 3 and 4 on pages 2-6 of the Office Action mailed April 24, 2003, and respectfully submit that all of the claims now presented for consideration by the Examiner patentably distinguish over the teachings of these references applied by the Examiner in rejecting claims in the Office Action mailed April 24, 2003, that is, the teachings of U.S. Patent No. 5,763,071 to Chen, et al., and the U.S. Published Patent Applications to Sakai, et al., No. 2002/0018917, and to Shimizu, et al., No. 2003/0059651, under the provisions of 35 USC 103.

Initially, attention is respectfully directed to the prior art date of Shimizu, et al., that is, September 13, 2002. This date of September 13, 2002, is after the actual U.S. filing date of the above-identified application, that is, February 19, 2002. While Shimizu, et al. claims priority based upon Provisional Application No. 60/324,532, filed on September 26, 2001, it is noted that the Examiner has not established that the Provisional Application No. 60/324,532 discloses the subject matter claimed in No. 2003/0059651, within the meaning of the first paragraph of 35 USC 112. Thus, it is respectfully submitted that the Examiner has not established Shimizu, et al. as prior art in connection with the above-identified application. At the very least, and if the Examiner maintains the prior art rejection using the teachings of Shimizu, et al., it is respectfully submitted that the Examiner must provide Applicants with a copy of Provisional Application No. 60/324,532, filed on September 26, 2001, and point out support in this provisional application for the subject matter claimed in No. 2003/0059651. See 35 USC 132.

In any event, note that the above-identified application claims priority under 35 USC 119 based upon Japanese Patent Application No. 2001/285306, filed

September 19, 2001. Thus, the filing date of the Japanese Priority Application for the above-identified application is prior to the filing date of the provisional application upon which Shimizu, et al. is based. Applicants have previously made a claim for foreign priority, and submitted a certified copy of the priority document, as acknowledged by the Examiner in Item 13 of the Office Action Summary of the Office Action mailed April 24, 2003. In addition, for satisfying requirements of 35 USC 119 and 37 CFR 1.55, enclosed herewith please find an English translation of Japanese Patent Application No. 2001/285306, filed September 19, 2001, together with a Statement of Accuracy of the translation.

As can be seen in this enclosed translation, Japanese Patent Application No. 2001/285306 claims the same invention as claimed in the above-identified application, and supports the subject matter claimed in the above-identified application within the meaning of the first paragraph of 35 USC 112. See pages 1 and 2 of the enclosed English translation; note also pages 5-9 thereof.

In view of the foregoing, it is respectfully submitted that Applicants have established their right to be accorded benefit of the filing date of Japanese Patent Application No. 285306/2001, filed September 19, 2001, which is prior to the filing date of the provisional application upon which Shimizu, et al. is based. Accordingly, reconsideration and withdrawal of Shimizu, et al. as prior art in connection with the above-identified application, for this reason alone, is respectfully requested.

Furthermore, and as set forth previously, if the Examiner maintains any rejection using the teachings of Shimizu, et al., Applicants respectfully request that the Examiner provide Applicants with a copy of Provisional Application No. 60/324,532, filed on September 26, 2001, and establish that Shimizu, et al. has a

date, for prior art purposes, of the filing of the provisional application (that is, show that the provisional application supports the subject matter claimed in Shimizu, et al., under the requirements of the first paragraph of 35 USC 112).

Since Shimizu, et al. does not constitute prior art in connection with the presently claimed subject matter, it is respectfully submitted that the claim rejection set forth in Item 3 on pages 2-4 of the Office Action mailed April 24, 2003, is moot. While Applicants do not agree with allegations made by the Examiner in connection with the prior art rejection set forth in Item 3 on pages 2-4 of the Office Action mailed April 24, 2003, such allegations need not be addressed since Shimizu, et al. clearly does not qualify as prior art in connection with the presently claimed subject matter.

In connection with the rejection set forth in Item 4 on pages 4-6 of the Office Action mailed April 24, 2003, it is respectfully submitted that the references as applied by the Examiner would have neither taught nor would have suggested such a perpendicular magnetic recording medium, or such a magnetic storage apparatus, as in the present claims, including wherein the recording medium has a layered structure of the magnetic layer containing Co and Cr as a main component above a substrate; a first layer formed on an opposite side of the magnetic layer relative to the substrate, this first layer including an amorphous alloy layer containing rare earth metals and 3d transition metals as a main component; and a second layer on the first layer, with this second layer containing Co and Cr. See claim 1. Note also the perpendicular magnetic recording media recited in claim 8.

Moreover, it is respectfully submitted that these applied references would have neither disclosed nor would have suggested the additional aspects of the present invention as in the remaining, dependent claims, having features of the

recording medium as discussed in connection with claim 1, and further including (but not limited to) wherein the first layer, which includes the amorphous alloy layer containing rare earth metals and 3d transition metals as a main component, is a multilayer film containing the amorphous alloy layer and other layers (see claim 2), especially wherein this multilayer film, which is the first layer, is composed of the specified amorphous alloy layer and an alloy film containing Co and Cr as a main component (see claim 3); and/or thicknesses of the first and second layers respectively as in claims 4 and 7; and/or wherein the first layer contains one of TbFeCo, TbCo and TbFe as a main component (see claim 5); and/or wherein the second layer consists of Co and Cr (see claim 6); and/or wherein the magnetic layer is the main recording layer of the recording medium (see claim 9); and/or wherein the first layer is a thermal-stabilizing layer of the recording medium (see claim 11); and/or wherein the second layer is provided on the surface of the first layer (note claim 12); and/or the additional structure of the protective and lubricant layer on the second layer (note claim 13), particularly wherein this protective and lubricant layer includes carbon, with the second layer suppressing reaction of the carbon (see claim 14), more particularly wherein this protective and lubricant layer is made of a material selected from the group consisting of carbon, silicon carbide and boron carbide (note claim 15).

The present invention is directed to a perpendicular magnetic recording medium having excellent thermal stability, and which is suitable for high density magnetic recording.

There are both longitudinal and perpendicular magnetic recording systems used in magnetic disk apparatuses. The perpendicular magnetic recording system

is one which forms recorded bits so that a magnetization direction of the recording medium is perpendicular to a medium surface, and magnetization directions in recorded bits adjacent to each other are in anti-parallel.

As a perpendicular magnetic film, a Co alloy having a hexagonal close-packed structure is mainly used; on the other hand, materials other than CoCr-based alloy series materials have been used as perpendicular magnetic recording materials, such as amorphous alloys made of rare earth-transition metals. Also, a thin film formed of a multilayer film, such as $(Co/Pd)_n$ and $(Co/Pt)_n$, has been investigated, these multilayer films having alternatively laminated Co films with films of Pd or Pt. Note, in particular, the paragraph bridging pages 2 and 3 of Applicants' specification.

As described in the paragraph bridging pages 3 and 4 of Applicants' specification, CoCr-based alloys do not have sufficient resistance to thermal fluctuations. On the other hand, while perpendicular magnetic recording media made of amorphous alloys of the rare earth-transition metals, and made of multilayer films, as discussed previously, are excellent in thermal stability and signal-to-noise ratio at low recording densities, perpendicular magnetic recording media made of these materials have a problem that noise at high recording densities is large. Note the paragraph bridging pages 3 and 4 of Applicants' specification. In addition, recording films made of these materials have additional problems in that it is difficult to manufacture the multilayer films, and the rare earth-transition metal alloys, which contain corrosive rare earth metals, have poor corrosion resistance.

In addition, a further problem found by the present Applicants is that when a rare earth-3d transition metal amorphous alloy is used as the recording layer, this

layer and carbon used as a protective film react with each other, so that sufficient thermal stability and signal-to-noise ratio cannot be obtained at a thin area in which a thickness of the recording layer is equal to several nm or less. Again, note the paragraph bridging pages 3 and 4 of Applicants' specification.

Against this background, Applicants provide a perpendicular magnetic recording medium, and a magnetic storage apparatus using this perpendicular magnetic recording medium, avoiding problems as discussed previously; and, in particular, providing structure excellent in thermal stability and having a high signal-to-noise ratio, and being suitable for high density magnetic recording. Applicants have found that by providing structure including a magnetic layer containing Co and Cr as main components, with a first layer formed on this magnetic layer, the first layer including an amorphous alloy layer containing rare earth metals and 3d transition metals as a main component, and with a second layer formed on the first layer, the second layer containing Co and Cr, objectives according to the present invention are achieved, and in particular a perpendicular magnetic recording medium having good thermal stability and good signal-to-noise ratio, and being suitable for high density magnetic recording, is achieved.

Thus, as stated, for example, in the first full paragraph on page 8 of Applicants' specification, the magnetic layer made of the amorphous alloy containing the rare earth metals and the 3d transition metals as the main component is used as a thermally stabilizing layer, on the main recording layer of Co and Cr. In addition, a cap layer of Co and Cr is formed on the surface of the thermally stabilizing layer. By including the cap layer, squareness is increased, and by sandwiching the thermally stabilizing layer between the alloy films containing Co and Cr as the main

component, a magnetic wall motion is suppressed, so that an effect of an increase in a signal-to-noise ratio in addition to an increase in thermal stability of recorded magnetization can be obtained. Note the sole full paragraph on page 8 of Applicants' specification.

Moreover, by providing the thickness of the second layer as in various of the present claims (note, for example, claim 7), thermal stability is improved by suppressing a reaction of material of the first layer with carbon of the protective and lubricant layer, and by suppressing corrosion; and, moreover, the signal-to-noise ratio increases due to suppression of the magnetic wall motion by sandwiching the thermally stabilizing layer between the alloy films containing Co and Cr as the main component. See the two full paragraphs on page 11 of Applicants' specification.

See also the paragraph bridging pages 13 and 14 of Applicant' specification, disclosing the optimum value of thickness of the thermally stabilizing layer, based upon considerations both of thermal stabilization and signal-to-noise ratio.

As to advantages achieved according to the present invention, attention is respectfully directed to the Examples and comparisons thereto as set forth in the Embodiments in Applicants' original disclosure. Note, for example, Embodiments 1-6 on pages 8-23 of Applicants' specification. It is respectfully submitted that the Embodiments show advantages achieved by various aspects of the present invention, including use of the first (thermally stabilizing) layer and second (cap) layer, particularly together with the protective and lubricant layer, as well as thicknesses of the first (thermally stabilizing) and second (cap) layers.

With respect to the rejection as set forth in Item 4 on pages 4-6 of the Office Action mailed April 24, 2003, Sakai, et al. discloses a perpendicular magnetic

recording medium, having a multi-layer construction for the magnetic recording layer, and of these multi-layers, at least one layer is a magnetic film of a rare earth-transitional metal alloy amorphous material. See paragraph [0011]. Note also the three embodiments of the multi-layer magnetic recording layer as disclosed in paragraphs [0012]-[0014] of Sakai, et al. Note also Fig. 1 and paragraph [0037], showing a soft magnetic back layer 2, an intercoat layer 3, a multi-layer magnetic recording layer 4 and a protective layer 5, each formed in order on a surface of a non-magnetic substrate 1; and also paragraph [0041], disclosing that the multi-layer magnetic recording layer 4 is constructed from a two layer magnetic layer, the first layer being a magnetic layer of a CoCr alloy crystalline film and the second layer being a magnetic layer of a rare earth-transitional metal alloy amorphous film. Note also paragraph [0045], describing examples of materials that can be used for rare earth-transitional metal alloy amorphous films. This patent goes on to disclose, in paragraph [0046], that it is known that rare earth-transitional metal alloy amorphous films do not have good corrosion resistance, and that by adding Cr at 5 atm% or greater and 25 atm% or less, this corrosion resistance can be improved.

It is respectfully submitted that Sakai, et al. discloses a multi-layer magnetic recording layer having at least the two-layer structure; and would have neither taught nor would have suggested the three-layer structure of magnetic layer of Co and Cr which is the main recording layer of the recording medium, together with the first (thermally stabilizing) and second (cap) layers providing thermal stabilization and good signal-to-noise ratio, while avoiding corrosion, as achieved according to the present invention.

The contention by the Examiner that Sakai, et al. discloses layers

corresponding to Applicants' magnetic layer, first layer and second layer, is respectfully traversed. It is respectfully submitted that Sakai, et al. discloses a magnetic recording layer which has multiple layers, including a Co-Cr alloy crystalline film and a rare earth-transitional metal alloy amorphous film, and would have neither taught nor would have suggested the structure including the magnetic layer (of the Co-Cr layer) together with the first layer (thermally stabilizing layer) and second layer (cap layer) as in the present invention.

It is respectfully submitted that the additional teachings of Chen, et al., would not have rectified the deficiencies of Sakai, et al., such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Chen, et al. discloses, inter alia, rotatable magnetic recording media, such as thin film magnetic disks. The structure disclosed in Chen, et al. includes a non-magnetic substrate; a Cr or Cr-alloy underlayer formed on the substrate; a first magnetic layer, which is magnetically anisotropic, formed on the Cr or Cr-alloy underlayer; and a second magnetic layer, which is magnetically isotropic, formed directly on the first magnetic layer, wherein the magnetic recording medium has a specific areal recording density and a specific Mrt. Note the paragraph bridging columns 2 and 3 of this patent. In a further aspect disclosed in Chen, et al., additional magnetic layers are used; on the first and second magnetic layers previously described, a first chromium or chromium-alloy intermediate layer is formed on the second magnetic layer; a third magnetic layer, which is magnetically anisotropic, is formed on the first intermediate layer, and a fourth magnetic layer, which is magnetically isotropic, is formed directly on the third magnetic layer. See column 3, lines 16-30. Note also the paragraph bridging columns 4 and 5,

describing that the magnetic layers used in Chen, et al. can be formed of conventional magnetic materials, such as Co-base alloys; and the second paragraph in column 5 of this patent, disclosing that the recording medium typically includes a carbon overcoat on the magnetic layers and a lubricant top coat on the carbon overcoat.

Initially, it is respectfully submitted that the teachings of Chen, et al. are not properly combinable with the teachings of Sakai, et al., under the requirements of 35 USC 103. Thus, Sakai, et al. is directed to a perpendicular magnetic recording medium, while Chen, et al. is directed to a magnetic recording medium having magnetically isotropic and anisotropic layers. It is respectfully submitted that one of ordinary skill in the art concerned with in Sakai, et al., directed to the perpendicular magnetic recording media, would not have looked to the teachings of Chen, et al.

That is, Sakai, et al., directed to perpendicular magnetic recording media, concerns such media avoiding problems of thermal fluctuation while providing a good signal-to-noise ratio and achieving a high recording density. Chen, et al. does not disclose perpendicular magnetic recording medium, and is directed to providing a medium having a high areal recording density. In view of differing technologies and problems addressed by each of Sakai, et al. and Chen, et al., it is respectfully submitted that these references are directed to non-analogous arts, and that the teachings thereof are not properly combinable.

Furthermore, particularly in view of differences in technologies involved in Sakai, et al. and Chen, et al., it is respectfully submitted that the Examiner has not established proper motivation for combining the teachings of these two references. As can be appreciated, there must be proper motivation for combining the teachings

of the references, in order for a proper rejection under 35 USC 103 to be made.

In any event, even assuming, arguendo, that the teachings of Sakai, et al. and of Chen, et al. were properly combinable, such teachings would have neither disclosed nor would have suggested the presently claimed invention, including the magnetic layer, together with the first and second layers as in the present claims. In this regard, the Examiner contends that it would have been obvious to have added the second layer in view of the teachings of Chen, et al. Such contention by the Examiner is respectfully traversed. It is respectfully submitted that Chen, et al. discloses structure having magnetically isotropic and magnetically anisotropic layers; and that such disclosure, even together with the teachings of Sakai, et al., would have neither taught nor would have suggested the adding of the second layer containing Co and Cr to the disclosed layers of Sakai, et al. For example, from the teachings of Chen, et al., and assuming, arguendo, that the teachings of Chen, et al. and Sakai, et al. were properly combinable, there is no basis for the conclusion by the Examiner of addition of a layer, rather than substitution of a layer.

Noting especially that Chen, et al. discloses the isotropic and anisotropic layers of the recording medium that are adjacent each other, the combined disclosures of Sakai, et al. and Chen, et al. would have taught away from the presently claimed structure having the first layer between the magnetic layer and the second layer.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

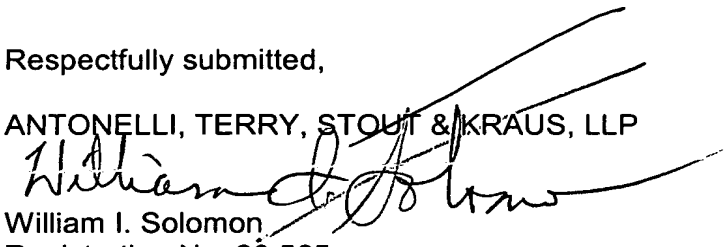
Attached hereto is a marked-up version of the changes made to the claims by the current Amendment. The changes are shown in the attachment captioned

"VERSION WITH MARKINGS TO SHOW CHANGES MADE".

To the extent necessary, Applicants petition for an extension of time under 37 CFR § 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account No. 01-2135 (Case No. 1021.41200X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Please amend the claims presently in the application as follows:

2. (Amended) The perpendicular magnetic recording medium according to claim 1, wherein said first layer is a multilayer film including the amorphous alloy ~~layers~~layer containing the rare earth metals and the 3d transition metals as the main component and other layers.

3. (Amended) The perpendicular magnetic recording medium according to claim 2, wherein said multilayer film is one composed of the amorphous alloy ~~layers~~layer containing the rare earth metals and the 3d transition metals as the main component and an alloy film containing Co and Cr as a main component.

6. (Amended) The perpendicular magnetic recording medium according to claim 1, wherein said second layer ~~is formed~~consists of Co and Cr.